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F. V. HAYDEN, U. S. GEOLOGIST-IN-CHARGE.

SOME ACCOUNT,

CRITICAL, DESCRIPTIVE, AND HISTORICAL,

OF

ZAPUS HUDSONIUS;

AND

ON THE BREEDING-HABITS, NEST, AND EGGS OF THE WHITE-TAILED PTARMIGAN,

LAGOPUS LEUCURUS.

BY

DR. ELLIOTT COUES, U. S. ARMY.

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ON THE BREEDING-HABITS, NEST, AND EGGS, OF THE WHITE-TAILED PTARMIGAN (LAGOPUS LEUCURUS).

By Dr. Elliott Coues, U. S. Army.

Very little having been placed on record respecting the breeding-habits, nest, and eggs of *Lagopus leucurus*, the present occasion is taken to bring together the information we possess on the subject, and supplement it with a more precise account, the result of an examination of a set of eggs which, with the nest, were collected during the summer of 1875 by one of Dr. Hayden's parties, and submitted to my inspection.

The White-tailed Ptarmigan is interesting as the southernmost species of the genus *Lagopus*, and the only one of any considerable latitudinal dispersion in the United States. The Willow Ptarmigan (*L. albus*) is indeed recorded from some points along our northern frontier, but even there its occurrence has only been noted in winter. *L. leucurus* alone breeds within the United States (exclusive of Alaska). It is one of the later additions to the genus, having remained unknown to naturalists up to the year 1831, when it was described and figured by Swainson and Richardson in the second volume of the *Fauna Boreali-Americana* (p. 356, pl. 63), from six specimens procured by Mr. Drummond and Mr. Macpherson in the Rocky Mountains, latitude 54° to 63° north. Mr. David Douglas had killed several in 1827, but these were destroyed. It is only within the last few years that we have become fairly well acquainted with the bird. The species is readily distinguished from its allies by the character implied in the name; the tail-feathers being pure white, like the rest of the plumage in winter.

Its known range in the United States has lately been extended to latitude 37° north; the species having been found at Cantonment Burgwyn, New Mexico, by Dr. B. J. D. Irwin, United States Army.* In longitudinal distribution, it is confined to the Rocky Mountains and some other high ranges in the West.

The earliest account of the nest or eggs which I have at hand is that given by Mr. C. E. Aiken,† who states that the bird is said to be common on the Snowy Range of Colorado Territory, and who describes the nest, upon the authority of a miner, as composed of leaves and grass, upon the ground, among bushes. The eggs in this case were said to have been fourteen in number, and "light bluish-brown, spotted with dark-brown," in color.

The first egg known to me to have been examined by a naturalist was an imperfect one taken by Mr. A. G. Mead, who procured it on Mount Lincoln, Colorado Territory, and by him presented to Mr. J. A. Allen, who kindly furnished me a short description, which I published in the account of the species given in the "Birds of the Northwest" (p. 426). According to Mr. Allen, it was "thickly sprinkled with small, bright

* Coues, Proc. Acad. Nat. Sci. Phila. 1866, p. 94.
† Proc. Bost. Soc. Nat. Hist. xv, 1872, p. 209.

reddish-brown dots, on a chocolate-colored ground, and measured about 2.00 inches in length by 1.20 inches in diameter". This same egg was also described by Dr. T. M. Brewer, in Baird, Brewer, and Ridgway, History of North American Birds, iii, 1874, p. 465.

The first account of the particular habits of the bird during the breeding-season was likewise communicated to me by another esteemed correspondent, Mr. T. Martin Trippe, C. E., who appears to have enjoyed excellent opportunities for observation among the mountains of Clear Creek County, Colorado Territory. "The Ptarmigan builds its nest," says Mr. Trippe, "in the latter part of June, and commences hatching toward the close of the month or early in July. The nest—which is always on or near the summit of a ridge or spur, many hundred feet above timber-line—is merely a depression in the ground, lined with a few straws, and white feathers from the mother's breast. The eggs are eight in number, of a light buff-brown, thickly sprinkled with spots of dark chocolate-brown, somewhat thicker at the larger end. While on her nest, the bird is very tame. Once while walking near the summit of the range, I chanced to look down, and saw a Ptarmigan in the grass, at my very feet—at the next step I should have trodden upon her. Seeing that she did not appear frightened, I sat down gently, stroked her on the back, and finally, putting both hands beneath her, raised her gently off the nest and set her down on the grass, while she scolded and pecked at my hands like a setting hen, and, on being released, merely flew a few yards and settled on a rock, from which she watched me till I went away. Late in July, I came across a brood of young ones, apparently not more than four or five days old. They were striped with broad bands of white and blackish-brown, and looked precisely like little game chickens. The mother flew in my face and hit me with her wings, using all the little artifices that the Quail and Partridge know so well how to employ, to draw me away; while her brood, seven or eight in number, nimbly ran and hid themselves in the dense grass and among the stones. On another excursion above timber-line, toward the close of August, I found most of the young ones nearly grown and strong on the wing; but one brood was of the size of Quails, showing that some birds must begin breeding much later than others, or that they occasionally raise two broods."—(Birds of the Northwest, p. 427.)

In the Proceedings of the Boston Society of Natural History, vol. xvi, p. 348 (1874), Dr. T. M. Brewer describes the fragments of a set of eggs received from Mr. T. M. Trippe, whose MSS. notes accompanying, published by Dr. Brewer, are to the same effect as those already quoted from the "Birds of the Northwest"; having apparently been drawn up from the same incident. This set of eggs was found June 28, 1873, on a high ridge a thousand feet above timber-line, near the Chicago Lakes, about fifteen miles from Idaho Springs, Colorado Territory. One of the eggs, though much damaged, admitted of being put together sufficiently to show its size, shape, and in fact all its characters. It is thus described by Dr. Brewer: "This egg is 1.70 inches in length by 1.21 in breadth; is oval in shape, one end being but very little smaller than the other. The ground-color is a rich creamy-drab, and the surface of the egg is pretty uniformly marked with small rounded dots of dark chestnut; these are about equally distributed over the entire egg, and are nowhere confluent."

A further contribution to the history of the species was made by Mr. J. H. Batty in the *Forest and Stream* (newspaper) of January 29, 1874. The writer has, however, little to say of the breeding-habits, and, as is now clearly seen, was in error in his supposition that the bird lays only

three or four eggs, having reasoned upon insufficient premises, as well as in the face of all analogy bearing upon the reproduction of species in this family of birds.

The material which forms the especial subject of this article consists of a nest and four eggs.

I am not informed that this number of eggs is to be considered as the nest-complement; nor is there any reason to believe that the clutch, had it been completed, would not have consisted of a greater number.

The specimens were taken by Mr. A. D. Wilson, topographer of the Southwest Division of Dr. Hayden's Survey, on the 15th of July, 1875, in the Sierra San Juan, Southern Colorado, near the headwaters of the Rio Grande del Norte, eleven miles southwest of Antelope Park, on a rocky plateau, at an altitude of about 12,400 feet. They are deposited in the National Museum, Smithsonian Institution, being No. 17200, S. I. Register. The authentication and identification are absolute; and the specimens are the first perfect ones which have been seen in any collection—as far as the writer's information goes.

The nest, in its present state, measures scarcely five inches in diameter by about an inch in depth. It thus seems rather small for the size of the bird, but is probably somewhat compressed in transportation. The shape is saucer-like, but with very little concavity of surface. The bottom is decidedly and regularly convex in all directions, apparently fitting a considerable depression in the ground. The outline is, to all intents, circular. The nest is rather closely matted, the material interlacing in all directions, and retains considerable consistency. The material is chiefly fine dried grass-stems; with these are mixed, however, a few small leaves and weed-tops, and quite a number of feathers. The latter—evidently those of the parent birds—are embedded throughout the substance of the nest, though more numerous upon its surface, where a dozen or so are deposited; there may have been some loose ones lost in handling.

The account of the color of the eggs, given by Mr. Aiken upon impersonal authority as "light bluish-brown", is altogether wrong. Nor does the color of the specimens before me seem to my eye to agree with the expression used by Mr. Allen respecting his specimen—"chocolate-colored". Dr. Brewer's phrase—"rich creamy drab"—is just about the mark, though I hardly perceive a shade of the color to which I attach the name drab. However, "drab" and "dun" are indefinite terms. I should say, simply, that the ground is dull cream-color; and in selecting this term I have the advantage of the opinion of an expert colorist. The general complexion of the egg is very notably different from that of the eggs of either *L. albus* or *L. rupestris*, owing to the much fewer and smaller spots. In the species just mentioned, the markings are so strong and so numerous that they confer the general tone; and it is difficult to render an ordinary pen-and-ink stroke legible. In the present case of *L. leucurus*, the ground-color is as evident as the markings, and the inscription on the shell is perfectly plain.

The markings are all small, for the most part sharp and distinct,—the occasional overlapping of the spots producing in no case a blotch of any considerable size—mostly rounded in contour, to all intents distributed evenly over the whole surface, and, of course, innumerable in number. Very few of the spots exceed a large pin's head in magnitude; the more conspicuous ones are of about such size, while numberless others are dots or mere points. The color of all the markings is the same, though the larger ones seem of a slightly darker shade than the others, simply because the pigment is laid on more heavily. This

color is dark burnt-sienna, approaching to umber-brown. "Chocolate," "mahogany," "chestnut," are all more familiar terms, which might be used to suggest the color. The markings are all superficial—none appear to be overlaid by shell-substance.

In shape, these eggs are very perfectly ovoidal, without notable pointedness at the smaller end or special flatness at the other; the greatest diameter being nearly across the middle. Three of the specimens measure as follows (the fourth being defective at the point): No. 1, 1.70×1.15; No. 2, 1.70×1.14; No. 3, 1.68×1.11 (inches and decimals).

The shell is smooth to the touch. Seen under a strong lens (Tolles's $\frac{1}{4}$-inch triplet), the surface resembles polished marble, consisting of irregularly-shaped, smooth-edged prominences, betwixt which are innumerable small circular pits or pores.

SOME ACCOUNT, CRITICAL, DESCRIPTIVE, AND HISTORICAL, OF ZAPUS HUDSONIUS.

By Dr. Elliott Coues, U. S. Army.

Having occasion to inspect specimens of this quadruped, collected under the direction of Professor Hayden, I have been led into a further investigation of the species, and have examined the whole of the material contained in the National Museum, Smithsonian Institution, as well as a considerable portion of the literature bearing upon the subject. The present brief article, sketched with pleasure at Professor Hayden's request, is incidental to three main points determined, namely:—

I. There is at present only one known species of *Zapus*.

II. The animal, usually referred to the *Muridæ*, differs from the *Muridæ* to a degree warranting the recognition of a family *Zapodidæ*. Such appreciation of the characters afforded was made in 1872 by Dr. Gill, who erected a family (*Jaculidæ*) for its reception. I may here allude to the presence of an upper premolar, not found in *Muridæ* proper; the different and peculiar construction of the anteorbital foramen; and the saltatorial development of the hind limbs. These and other characters are amplified beyond.

III. None of the various generic names which have been applied to *Zapus hudsonius* are tenable according to recognized rules of nomenclature. Of these, *Dipus* and *Gerbillus* are too obviously inapplicable to require comment. *Jaculus* of Wagler (1830) belongs here; but the name had been used before in an entirely different connection. *Meriones* is in similar case; its original application by Illiger was to another type. Though it was subsequently transferred by Frédéric Cuvier to the present animal (Illiger's being already provided with a name), it cannot stand in this connection; for no synonym of one genus shall become the tenable name of another. A new name, therefore, being required, *Zapus** is proposed; the introduction of the term, of course, necessitating corresponding change in the appellation of the family.

Family ZAPODIDÆ.

< *Subfamily Dipodinæ*, Baird, M. N. A. 1857, 428.
= *Family Jaculidæ*, Gill, Arrangement of the Families of Mammals, 1872, 20.

Genus ZAPUS, Coues. (*g. n.*)

Dipus, sp.; *Gerbillus*, sp., Aliq.
Meriones, F. Cuvier, Dents des Mammifères, 1825 ?, p. —.—Audubon & Bachman, Q N. A. ii, 1851, 251. *Not of Illiger*, 1811.
Jaculus, Wagler, Syst. Amph. 1839, 30.—Baird, M. N. A. 1857, 429. *Not of Jarocki.*

* Etym. *Za*, augmentative particle, and *πους*, pes.—This very pat name was suggested to the writer by Dr. Gill, who, however, considers the name *Meriones* to be tenable for this genus.

ZAPUS HUDSONIUS, Coues.

Synonymy.

Dipus hudsonius, ZIMMERMANN, Geog. Gesch. ii, 1780, 358, No. 268 (based on the Long-Legged Mouse of Hudson's Bay, of Pennant).
BODDÆRT, Elench. Anim. i, 1784, 115 (based on Zimmermann).
"SCHREBER, Säug. , 861, No. 6."
FISCHER, Syn. Mamm. 1829, 340 (based on Zimmermann).
Gerbillus hudsonius, RAFINESQUE, Am. Month. Mag. 1818, 446.
LESSON, Man. i, 1827, 257.
Meriones hudsonicus, AUDUBON & BACHMAN, Q. N. A. ii, 1851, 251, pl. 85.
Jaculus hudsonius, BAIRD, M. N. A. 1857, 430, pl. 21, f. 5*a–e*.
NEWBERRY, P. R. R. Rep. vi, 1857, 59 (California).
BAIRD, P. R. R. Rep. x, 1859, Gunnison's & Beckwith's Routes, Mamm. p. 8.
COOPER & SUCKLEY, Nat. Hist. Wash. Terr. 1860, 83, 101, 127.
HAYDEN, Trans. Amer. Philos. Soc. xii, 1862, 147 (Fort Union).
SAMUELS, Ninth Ann. Rep. Mass. Board Agric. 1862, 178 (habits).
GILPIN, Proc. & Trans. Nova Scotia Inst. ii, 1870, 60 (Nova Scotia).
ALLEN, Bull. Mus. Comp. Zool. i, 1870, 226 (Massachusetts).
TENNEY, Am. Nat. vi, 1872, 330, f. 101 (habits).
MERRIAM, U. S. Geol. Surv. Terr. 1872, 665.
AMES, Bull. Minn. Acad. i, 1874, 70 (Minnesota).
ALLEN, Bull. Ess. Inst. vi, 1874, 60, 65 (Wyoming and Utah).
Mus longipes, ZIMMERMANN, Penn. Arktische Zool. i, 1787, 131 (erroneous identification with *Mus longipes* auct.).
Mus canadensis, "PENNANT" (mere Latin rendering of "Canada rat"?).
Dipus canadensis, DAVIES, Trans. Linn. Soc. iv, 1798, 155, pl. 8, f. 5, 6 ("Jumping Mouse of Canada").
SHAW, Gen. Zool. ii, 1801, 192, pl. 161 (after Davies).
TURTON, Syst. Nat. i, 1806, 100.
ORD, Guthrie's Geog. 2d Am. ed. 1815, 292.
FISCHER, Syn. Mamm. 1829, 339.
Gerbillus canadensis, DESMAREST, Mamm. ii, 1822, 331.
HARLAN, Fn. Amer. 1825, 155.
GODMAN, Am. Nat. Hist. ii, 1st ed. 1826, p.—; 2d ed. 1831, 94, pl.—; 3d ed. 1861, 94.
GRIFFITH, Anim. Kingd. v, 1827, 240, No. 624.
EMMONS, Mass. Rep. 1840, 69.
THOMPSON, Nat. Hist. Vermont, 1853, 44.
HALL, Canad. Nat. & Geol. vi, 1861, 304 (Montreal).
Meriones canadensis, LESS., Man. i, 1827, 258.
SCHINZ, Syn. Mamm. ii, 1845, 91.
Dipus americanus, BARTON, Amer. Philos. Trans. iv, 1799, 115, pl.—; vi, 1804, 143.
ORD, Guthrie's Geog. 2d Am. ed. 1815, 292.
Jaculus americanus, WAGLER, Syst. Amphib. 1830, 23.
Meriones americanus, DEKAY, N. Y. Zool. i, 1842, 70, pl. 24, f. 2.
Dipus labradorius, TURTON, Syst. Nat. i, 1806, 99 (Labrador Rat of Pennant).
ORD, Guthrie's Geog. 2d Am. ed. 1815, 292.
Mus labradorius, J. SABINE, App. Frankl. Journ. 1823, 661.
Gerbillus labradorius, HARLAN, Fn. Amer. 1825, 157 (after Sabine).
GODMAN, Am. Nat. Hist. ii, 1st ed. 1826, p.—; 2d ed. 1831, 97; 3d ed. 1861, 97.
GRIFFITH, Anim. Kingd. v, 1827, 240, No. 625.
Dipus labradoricus, FISCHER, Syn. Mamm. 1829, 338.
Meriones labradorius, RICHARDSON, F. B.-A. i, 1829, 144, pl. 7.
WAGNER, Suppl. Schreb. iv, —, pl. 226 B (after Richardson).
DAWSON, Edinb. N. Philos. Journ. 1856, 2.
Meriones labradorus, SCHINZ, Syn. Mamm. ii, 1845, 92.
Jaculus labradorius, WAGNER, Suppl. Schreb. iii, 1843, 294.
GIEBEL, Säug. 1855, 599; Zeitschr. gesammt. Naturw. xxv, 1865, 272 (osteology).
KENNICOTT, U. S. Patent-Office Agric. Rep. for 1856, 1857, 95, pl. 11 (habits).
MAXIMILIAN, Arch. Naturg. 1861, p.—; Verz. Reise N.-Am. 1862, 146.
Gerbillus sylvaticus, "MITCHILL." descr. nulla.
Meriones nemoralis, Is. GEOFFROY, "Dict. Class. vii, 323; pl. fasc. 10, n. 2."
Gerbillus daviesii, RAFINESQUE, "Préc. Découv. Sémiol. 14."
? Gerbillus soricinus, RAFINESQUE, "Préc. Découv. Sémiol. 14."
DESMAREST, Mamm. ii, 1822, 322 (compiled from Rafinesque).
LESSON, Man. i, 1827, 257 (compiled from Rafinesque).
Dipus soricinus, FISCHER, Syn. Mamm. 1829, 339 (compiled from Rafinesque).

? Gerbillus leonurus, RAFINESQUE, Am. Month. Mag. 1818, 446.
DESMAREST, Mamm. ii, 1822, 322 (compiled from Rafinesque).
LESSON, Man. i, 1827, 257 (compiled from Rafinesque).
? Dipus leonurus, FISCHER, Syn. 1829, 339 (compiled from Rafinesque).
? Gerbillus megalops, RAFINESQUE, Am. Month. Mag. 1818, 446.
DESMAREST, Mamm. ii, 1822, 322 (compiled from Rafinesque).
LESSON, Man. i, 1827, 257 (compiled from Rafinesque).
? Dipus megalops, FISCHER, Syn. 1829, 340 (compiled from Rafinesque).
? Gerbillus macrourus, RAFINESQUE.
? Gerbillus brachyurus, RAFINESQUE.
Meriones microcephalus, HARLAN, Proc. Zool. Soc. Lond. vii, 1839, 1.
SCHINZ, Syn. Mamm. ii, 1845, 92 (compiled from Harlan).
Meriones acadicus, DAWSON, Edinb. N. Philos. Journ. iii, 1856, 2, pl. 1.
Canada Rat, PENNANT, Quad. ii, , 172.
Labrador Rat, PENNANT, Hist. Quad. 1781, 435, No. 295; Arct. Zool. i, 1784, 132, No. 63.
Jumping Mouse of Canada, DAVIES, *l. c.*
Labrador or Jumping Mouse, GODMAN, *l. c.*
Canadian Jerboa, SHAW, *l. c.*
Labradore Jerboa, TURTON, *l. c.*
Canadian and Labrador Gerbil, GRIFFITH, *l. c.*
Deer Mouse, DEKAY, *l. c.*
Gerbille du Canada, DESMAREST, *l. c.*
Mérione du Canada, LESSON, *l. c.*
Gerbille soricine, de la baie d'Hudson, queue de lion, et aux yeux noirs, LESS., *l. c.*
Canadische, Labradorische, Kleinköpfige Hüpfmaus, SCHINZ, *l. c.*

Description.

Cranial and dental characters.—In comparison with the murine forms with which it has been associated, this animal presents many strong peculiarities of the skull and teeth. Among these may be enumerated the presence of an additional tooth in the upper molar series, causing an inequality in the formulæ of the two jaws; the size and shape of the anteorbital foramen, with its supplementary foramen or nick just beneath; the extension of the malar bone up the slender styloid zygomatic portion of the maxillary till it sutures with the lachrymal, and the slenderness and depression of the rest of the zygomatic arch; the shortness and transverse position of the bullæ auditoriæ; the position of the maxillo-palatine suture; expansion of the posterior nares, &c. The skull, as a whole, is shorter for its width, though the zygomata are even more nearly parallel; it is also deeper for its other dimensions, with a greater degree of convexity, both lengthwise and crosswise, of the superior contour. Nevertheless, its general superficial resemblance, aside from details, to that of *Mus* proper, is evident. Compared with that of *Mus musculus*, which is of about the same size, we see in each species the same general shape and delicate papery condition, without strong angularity, as well as many close coincidences in detail, indicating that the murine affinities of the family are with typical *Mus*, *Hesperomys*, &c., and not with the arvicoline group of *Muridæ*, in which the skull is notably heavier, more massive, and angular.

As to the general shape of the skull, there is little to be added to the foregoing, except such points as, being equally applicable to the familiar *Mus musculus*, need not be recapitulated; we may therefore at once proceed to details.

The anteorbital foramen, which transmits the masseter in this instance, and which constitutes a prime peculiarity of the skull, is of great size and obliquely oval in shape. Instead of being circumscribed by a plate of bone, as in *Muridæ*, it is defined externally by a very slender styloid process of the maxillary, which is strengthened by the upward extension of the malar, applied as a splint along its whole length. Below this main foramen there is another much smaller one, which transmits the

nerve. It is sometimes a complete foramen, separate from the other; sometimes only a deep notch in the lower border of the main opening; and this difference may be observed on the two sides of the same skull. I am ready to believe that this lesser opening, giving passage to the superior maxillary nerve, is the true "anteorbital" foramen itself; for it seems to correspond to the lower part of the large slit in *Muridæ*, which is walled in by the maxillary lamina, and it is formed by a little plate of bone, which rises as a ridge from the alveolar portion of the jaw, and bends over to abut against the main wall of the maxillary. In cases in which this plate fails to reach the main wall of the maxillary, so that only a notch and not a foramen results, the correspondence of the whole opening with the pyriform slit of the *Muridæ* is very evident, and the relation of the parts is fully established, though the shape is quite different.

The contour of the parts surrounding the foramen is such, that the zygomatic process of the maxillary stands out from the bone at right angles at a point scarcely above the level of the alveoli. The anterior root of the zygoma is hence notably depressed in position; there being no forward-upward reach of the lower border of this arch, so evident in *Muridæ*. The zygoma, in fact, is nearly horizontal in all of its length along the under side; but anteriorly the upper edge rises prominently, in consequence of the unusual extension of the malar up the maxillary, already mentioned. The malar runs all the way up to the lachrymal bone, affording a circumstance I have not seen elsewhere, and which I believe to be very rare, namely, a lachrymo-malar suture. This ascending spur of the malar is, moreover, expanded into a rather broad lamina, partly defending the orbit, thus supplying a wall that, in most cases, is afforded by expansion of the zygomatic process of the maxillary; the latter being in this case of styloid character. In its continuity, the malar is a slender rod; behind, it underlaps a short spur of the squamosal with simple squamous suture.

The general shape of the orbit is much the same as in *Mus*. In both, the squamosal forms much of the posterior orbital wall; the orbito-sphenoid being correspondingly reduced. The antero-exterior corner of the parietal reaches to the brim of the orbit.

The rostral portion of the skull bears to the rest about the same proportion as in *Mus*, and is equally attenuate anteriorly, though thicker at the base, and consequently more tapering. The ends of the nasals project conspicuously beyond the plane of the incisors; behind, these bones terminate opposite the ends of the intermaxillaries; the suture of the frontal with each of them, as well as with the maxillaries, being nearly in one transverse jagged line. The intermaxillaries develop a strong alveolar plate, separating the superior incisors for nearly half their length; this, with the projection of the nasals and backward set of the much-curved teeth, results in a snout strikingly like that of the *Saccomyidæ*. The feeble retreating under jaw, densely hairy upper lip, and small nasal pads, bear out this resemblance in the external physiognomy.

As in *Mus*, the interorbital constriction is moderate, being about as wide as the rostrum at base; and there is no trace of postorbital processes. The parietals are nearly square, though somewhat emarginate in front, to correspond with the convexity of the frontal. There is little, if any, dipping-down of a postero-exterior angle, so well exhibited in *Mus*. The interparietal is of a large size transversely, though narrow in the other direction; it reaches across the whole width of the combined parietals, bounding them both posteriorly, as it is itself bounded

by the occipital. The extent of this narrowly elliptical transverse interparietal is greater than in *Mus;* its corner is at a point where the back outer angle of the parietal, back upper angle of the squamosal, and front upper angle of the occipital all come nearly together. The squamosal closely resembles that of *Mus* in size, shape, and connections; there are the same extensive vacuities about the petrosal, with a similar strong clasp, bridging over the opening just above the meatus, running from the root of the zygomatic process to the back edge of the bone. The mastoid is of moderate size, developing nothing to be fairly called a process, wedged between the paroccipital process and the squamosal, at the postero-lateral corner of the skull. It is confluent with the petrosal, but partially fissured away from the surrounding occipital elements. The supraoccipital is of large size and convex contour; the occipital crest is slight, so that the plane of the occiput is not well defined from that of the superior surface of the skull, the two meeting with a continuous curve, more convex than in *Mus*. The upper border of the occipital is nearly straight, and bounded quite across by the interparietal; next comes a considerable piece of squamosal suture, and then the mastoid. The foramen is of great size and nearly hexagonal shape; most of it being in the one plane of the occiput, with only a slight nick inferiorly. The condyles are protuberant and convergent; the condyloid foramen is close beneath their articular surfaces. The paroccipital are well-marked vertical processes. The basioccipital narrows very rapidly, owing to the strong inward trend of the petrosals, and ends by transverse suture, as usual, with the basisphenoid, opposite the ends of these bones. Its under surface shows a pair of slight depressions, with a median ridge.

The posterior nares are of ample dimensions, owing to the wide separation of the pterygoids. These bones are long, straight, and styloid, with a slightly-clubbed extremity in close approximation to the ends of the petrosals. The palate ends behind with a broad, rounded emargination opposite the last molars. This formation is very different from that of *Mus*, in which the bony palate extends back of the molar series, and the contracted interpterygoid space is narrowly angular. The maxillopalatine suture of *Zapus*, likewise, is differently located, being opposite the interspace between the penultimate and preceding molar, instead of much farther back. There is a pair of conspicuous palatal foramina opposite the penultimate molar. The contour of the palate differs from that of *Mus*, and perhaps a majority of allied rodents, in being broader in front than behind. The incisive foramina are of great length, as well as quite broad, reaching from little behind the incisors to opposite the molars; the perforation is half in the intermaxillary, half in the maxillary; the bony septum is bullous except at its posterior part.

The form of the descending process of the mandible is a strong character of *Zapus* in comparison with *Mus*, &c., in which this plate of bone is more or less squarish, and vertical or nearly so. In *Zapus*, the same plate is strongly twisted out of the axis of the jaw, standing diagonally outward and upward—very much so, in fact, as witnessed in the *Saccomyidæ*. The coronoid is rather weak, falcate, acute, with a strong slope; it slightly overtops the condyle. The latter sets strongly backward, though it is rather more erect than in *Mus*. The incisor causes a moderate protuberance outside, at the root of the condylar process. Inside, nearly opposite, is the conspicuous foramen of the inferior maxillary nerve.

The superior incisors are short and stout, with a strong curve; their anterior faces strongly sulcate, with the outer half of the tooth rabbeted down so that the groove is plainly visible from the side. The inferior incisors are not specially noteworthy. The molar series differs from

that in *Muridæ* proper in the presence of a small anterior molar (premolar) in the upper jaw, with no tooth to correspond in the lower series. The minute premolar is single-rooted; the three following teeth have three roots apiece—a lengthwise pair of slender fangs outside, and a single stout fang, apparently formed of two coalesced roots, inside. The lower molars have each a pair of roots, in single lengthwise series. The anterior upper molar is the smallest of the whole, and simply circular; the next two are about equal in size; the last is much smaller. A similar proportion is seen in the under series. The pattern of the molar crowns is much complicated.

External characters.—A general murine form is modified by the great development of the hind limbs (much as in *Dipodidæ* or some forms of *Saccomyidæ*), and especially of the pes itself; an unusual length of tail, which greatly exceeds that of the body; a peculiar condition of the external ear; and a physiognomy quite like that of the *Saccomyidæ*. There are also well-developed internal cheek-pouches, shared in a less degree, however, by various American *Muridæ*.* These pouches, as well as can be judged from alcoholic specimens, are relatively about as large as those of *Tamias* for instance.

The body of *Zapus* is large behind, in correlation with the greatly-developed posterior limbs, and tapers to the fore in a regular manner; the head being comparatively small, and there being no noticeable constriction of the neck. The head is conoidal, with a prominent and rather blunt snout and retreating under jaw. The rather small eye is midway between the nose and ear. The upper lip is not visibly cleft, and is densely hirsute, with a fringe of hairs depending over and almost hiding the small front teeth. The naked muffle is of rather small size, and entirely inferior in position; above it, the hairy skin crosses with a deep transverse crease, forming a sort of imperfect overhanging flap, which is freely movable back and forth, even in alcoholic specimens, and looks as if it might be drawn down to partially cover the nostrils. (I have observed much the same thing in *Saccomyidæ*.) The nose-pad is impressed with a pair of median vertical grooves, and a transverse one is seen in some cases. The nostrils are completely lateral in position. The whiskers are rather sparse, but some of them are nearly half as long as the body.

The structure of the external ear is rather remarkable (among rodents) for the provision for perfect closure of the meatus, as in the *Soricidæ* for instance. The antitragus develops into a great flap, completely reversible, and capable of being applied against the meatus; and such, in fact, appears to be its usual position. The tragus, likewise, expands into a wide frill, or thin, free, rounded border, which ordinarily lies in apposition to the antitragal lobe opposite, completing the closure of the ear. On turning over these two flaps, the vestibule of the ear is seen to be of unusually large dimensions. The conch itself is of an ordinary contour, coming to a blunt point above; the anterior third is folded close back. The back of the ear and the fold of the conch are sparsely pilous; the

*The presence of cheek-pouches in the genus *Hesperomys* was first noted in 1830 by Gapper, who referred specimens of the common *Hesperomys leucopus* to *Cricetus* on this account, establishing a species *C. myoides*. In this matter, he was succeeded by Baird in 1857, who also recognized the pouches, and endorsed a *Hesperomys myoides* mainly upon this feature, failing, however, to observe that they also existed in other species of the same genus. At the same time that Mr. J. A. Allen announced the before unknown pouches of *Zapus hudsonius*, he also showed that they occurred as well in various species of *Hesperomys;* and my subsequent dissections have satisfied me that pouches are present in all the North American species of *Hesperomys* proper; *i. e.*, the subgenus *Vesperimus* as established by me; Proc. Acad. Nat. Sci. Phila., 1874, 178.

exposed parts of the front of the ear being more thickly clothed. The antitragal pad bears on its outer surface a special tuft of long hairs; its other side being naked, as are both sides of the flap of the tragus.

The fore limbs are absolutely small as well as short relatively to the hinder ones; and they seem to be placed rather far forward, though this appearance may be due, in part at least, to the tapering shape of the body. The hands are pilous above, naked below. There are four perfect fingers, with ordinary claws, and a rudimentary thumb, which bears a flat, blunt nail. The third digit is the longest; the fourth, second, and fifth being successively shortened. The digits are regularly transversely scutellate below. The palm is granular throughout, with a pair of large smooth pads (inner and outer) near the wrist, and three smaller tubercles at the base of, respectively, the second, the fifth, and the conjoined third and fourth digits.

The elongation of the hind limbs, which confers the high degree of saltatorial power upon this animal, like that of *Dipus*, &c., to which it has been referred, is especially noticeable in the pes, which exceeds the crus in length. This development of the foot, nevertheless, is not accompanied by reduction of the digits in number, nor by any imperfection of their respective metatarsals. The number of these bones has been queried; I find five, perfect from end to end, with complete tarsal and phalangeal articulations. The foot is clothed above with short, soft, silky hairs, quite different from the hirsute pelage of the body; below it is entirely naked, though the lateral fringe of hairs encroaches upon the contracted heel. The sole is perfectly smooth (as in *Mus*) for about half-way, then granular; the digits are transversely scutellate underneath. There is a well-defined tubercle on the inner side a little distance above the base of the first digit, and four others at the bases of, respectively, the first, second, fifth, and conjointed third and fourth digits. There are five perfect and normally-clawed digits. The first is shortest, and also situated rather high up, so that its tip reaches only to about the base of the second. The fifth is next longer, reaching the middle of the fourth. The third slightly exceeds the fourth and second, which are about equal to each other. There is much basal webbing between the three intermediate digits—especially between the third and fourth—which carries their apparent bases far beyond the bases of the lateral digits.

In its relative length, the tail exceeds that of any other North American (mammal?) rodent, always greatly exceeding the head and body, and sometimes measuring nearly twice as much. It is cylindrical, with uniform taper and very slight caliber, coming to a fine point with a slight pencil of hairs. Its hairiness is about on a par with that of *Mus musculus*, *decumanus*, &c.; that is to say, insufficient to hide the verticillate whorls of scales between which the short hairs spring.

The general pelage of this animal is coarse and hispid, with little gloss, and presenting a streaky or "staring" appearance, owing to the number of bristly hairs which are mixed with the softer under fur. The color varies a good deal in different specimens, though one pattern is pretty constantly preserved. About one-third of the colored part of the fur—that is to say, a dorsal strip about as wide as the lateral strip on either side—is brownish-yellow, heavily shaded with brownish-black. The sides, with the outer surface of the limbs, are of this same sandy-yellowish, but so slightly lined with the blackish that the purity of the light color is scarcely interfered with. The under parts are snow-white, with a pretty sharp line of demarcation from the colored areas. The backs of the hands and feet are whitish. The tail is rather indistinctly

bicolor, to correspond with the body-areas—dark-brown above, whitish below. The ears have a light-colored rim. The whiskers are mostly black. The basal part of the fur, in the colored areas, is gray or plumbeous, excepting just along the line of junction of the tawny of the sides with the white of the belly, where the hairs are white to the roots, like those of the belly. To this absence of dark bases of the hairs is due the appearance of a fulvous stripe along the sides, sometimes quite strongly marked, much as in species of *Perognathus* or *Cricetodipus*. In these cases there are thus four styles of coloration from back to belly: the dark dorsal area, mixed blackish and sandy, with plumbeous roots; sandy, with little or no blackish, but still with gray roots; sandy, with white roots; and finally pure white. The variations to which the species is subject lie in the brightness or dullness of the tawny, and its lining with a varying amount of blackish; the degree of distinctness of the dorsal area from that of the sides, and of this from the white of the belly; and in the sharpness or indistinctness of the tawny lateral stripe along which the hairs are white at the roots. The line of the belly-white is pretty constantly sharp, as in *Hesperomys;* but there is often a very gradual shading from the dark dorsal area to the tawny of the sides, and the latter is sometimes very pale yellowish-gray, &c. I have observed no plumbeous or entirely gray stage like that of young *Hesperomys* in general; and I have failed to determine what definite relation, if any, the observable differences in coloration bear to sex or age.

The animal varies much in size, and to some extent in proportions, especially the length of the tail. This is the most variable dimension, as usual in all such cases of high development of parts. A tendency to superior size in specimens from the Rocky Mountains and westward has been noted. The following table of measurements of an alcoholic series indicates very fairly the dimensions, and, to some extent, the variations, in size and proportions:

Measurements of twenty-one alcoholic specimens (English inch and decimals).

National Museum No.	Locality.	From tip of nose to—				Tail—	Length of—	
		Eye.	Ear.	Occiput.	Tail.	Vertebræ.	Fore foot.	Hind foot.
2592	Halifax, N. S	0.45	0.80	1.00	2.75	5.00	0.40	1.20
2393	Middleboro', Mass	0.42	0.75	1.00	2.90	5.25	0.35	1.18
2395	....do	0.45	0.90	1.00	3.00	5.00	0.37	1.20
2396	....do	0.42	0.80	0.95	2.75	4.50	0.45	1.18
2397	....do	0.40	0.80	0.95	3.00	5.30	.....	.....
2398	....do	0.43	0.85	1.00	2.75	4.75	0.35	1.15
2594	Burlington, Vt	0.45	0.90	1.00	3.30	5.35	0.40	1.18
2599	Wethersfield, Conn	0.45	0.90	1.00	2.75	4.80	0.40	1.10
2600	....do	0.45	0.80	1.00	2.75	4.35	0.35	1.15
2605	Waterville, N. Y	0.45	0.90	1.10	3.10	4.95	0.45	1.15
2606	....do	0.50	0.95	1.00	3.25	5.00	.....	.....
2607	....do	0.45	0.85	1.00	2.85	4.90	0.40	1.15
2608	....do	0.45	0.90	1.00	3.00	5.00	0.40	1.15
2604	Philadelphia, Pa	0.45	0.85	1.00	2.90	4.65	0.45	1.13
2601	Carlisle, Pa	0.45	0.85	1.00	2.85	4.50	0.45	1.15
2602	....do	0.45	0.85	1.00	2.85	4.75	0.45	1.15
2603	....do	0.40	0.80	0.95	2.60	4.40	0.40	1.05
2611	West Northfield, Ill	0.40	0.80	0.90	2.80	4.70	0.40	1.10
2610	Upper Missouri	0.50	1.00	1.15	3.00	5.10	0.48	1.15
1929	Platte River, Nebr	0.40	0.80	0.95	2.75	4.50	0.45	1.12
2609	Steilacoom, W. T	0.45	1.00	.....	.....	6.10	0.50	1.35
	Average	0.44	0.86	0.99	2.89	4 90	0.42	1.15

Skulls measure from 0.90 to 1.00 by 0.45 to 0.50.

Geographical Distribution.

The dispersion of *Zapus hudsonius* in North America can at present be given only in somewhat general terms, pending precise information respecting both northern and southern limits of its distribution. It inhabits the greater part of British America and the United States, from ocean to ocean. The northernmost recorded locality we have noted is Great Slave Lake, latitude 62°; and the southernmost is Virginia, where we have ourselves observed it. It was originally described from Hudson's Bay, Labrador, and Canada, and appears to be particularly numerous in the last-named region and northern half of the United States. Audubon surmises, with much reason, that it exists south of Virginia, at least in mountainous regions; while there is no doubt of its presence in elevated portions of Arizona and New Mexico, which harbor such a truly boreal animal as *Gulo luscus*. We have found it in Dakota, and it is known to exist on the Pacific coast, in Washington Territory; while the moist and comparatively warm climate of the wooded region, thence northward, we may properly surmise, will carry its habitat far into Alaska. Its dispersion will probably ultimately prove to be little, if any, less extensive than that of *Hesperomys leucopus*; although, as it is more strictly a woodland animal, there are large treeless areas within its general range where probably it does not occur.

History.

The latter part of the last century gave us our early accounts of this animal under four different names, from three distinct sources—Pennant, Davies, and Barton. Thomas Pennant appears to have first described it under the name of the "Long-legged Mouse of Hudson's Bay", whence comes the first technical appellation *Dipus hudsonius*, conferred by Zimmermann in 1780. Pennant also had a "Labrador Rat", the description of which applies perfectly to the present species; and, furthermore, a "Canada Jerboid Rat", failing to recognize the fact that all three were the same. Pennant further erred in hastily identifying the animal sent from Hudson's Bay by Mr. Graham with the *Mus longipes* of Pallas, or *Dipus meridianus* of Gmelin, an Asiatic quadruped. Pennant's three animals became the bases of as many technical names—*hudsonius*, *labradorius*, and *canadensis*—the last of these at the hands of General Davies, who, in 1797 or 1798, communicated to the Linnæan Society "an account of the Jumping Mouse of Canada (*Dipus canadensis*)", which was published in the Transactions of that body for 1798, as above cited, accompanied by figures. General Davies gave a fair account of the animal, which was copied into Dr. G. Shaw's General Zoology, with the figures representing the creature in activity and repose. These cuts, though now seeming very rude, are quite characteristic and unmistakable. Joseph Sabine is currently accredited with the authorship of the term *Mus labradorius*, based upon Pennant's Labrador Rat; but a *Dipus labradorius* had already appeared in 1806 in Turton's English version, with compiled additions, of the Linn.-Gmelinian Systema Naturæ. Meanwhile, the third independent source of information, following Pennant and Davies, had appeared in 1799, when Prof. Benjamin S. Barton gave "some account of an American species of Dipus or Jerboa", and named the animal *Dipus americanus* in the Transactions of the American Philosophical Society, as above cited. This seems to have been the earliest reference to the animal as an inhabitant of the United States; and the name was given in ignorance of the earlier accounts from British

America. Such, however, was not the case with the two later synonyms we have adduced. After treating of "*Gerbillus labradorius*" from fair acquaintance in 1825, Dr. Harlan, in 1839, described specimens from Philadelphia as a new species, under the designation of *Meriones microcephalus;* while, still later, Nova Scotian examples received from Principal Dawson the appellation of *Meriones acadicus*. But the characters adduced by both of these authors fail to indicate anything tangible; and it is certain that if more than one species of *Zapus* inhabits North America, it remains to be discovered; for the several queer animals of this kind indicated about the year 1817 by M. Rafinesque, under the names of Short-tailed, Long-tailed, Lion-tailed, Shrew-like, and Big-eyed, are undoubtedly figments of that author's fertile imagination. We quote these names with a query, together with the compiled accounts that go with them, merely observing that, if they do not belong to *Zapus hudsonius*, they certainly belong nowhere else. To give credit where it is due, however, we should not omit to add that, besides these five "new species" of "Gerbillus", M. Rafinesque furnishes us with two others—*G. dariesii*, which is merely another name for Davies's *Dipus canadensis*, and *G. hudsonius*, in presenting which last he has the credit of leading the adoption of the specific name which has priority, and which must unquestionably be adopted. Recurring once again for a moment to the earlier dates in the history of the species, we find a name *Gerbillus sylvaticus*, imposed by Mitchill, but without an accompanying description; and still another, said to have been given by Isidore Geoffroy in the seventh volume of the Dictionnaire Classique—*Meriones nemoralis*.

It would appear, from the foregoing sketch of its history, that this animal was already quite sufficiently named; but this is only a consideration of its specific appellations, without reference to the various generic terms by which it has been designated by authors, nearly all of whom seem determined to make it out to be some kind of a Jerboa, because of its powers of leaping. But nothing is more certain than that it is not generically related to any of the *Dipodidæ*. It has usually been placed at least in a subfamily *Dipodinæ*. The family value of its characters were only lately recognized, when, in 1872, Dr. Gill constituted a family *Jaculidæ*, overlooking the fact, as Professor Baird had also done, that the name *Jaculus* was pre-occupied in another connection.